Laparoscopic Treatment of Gastric Tumors

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ABSTRACT

Purpose: To assess the use of different laparoscopic approaches in the management of gastric tumors based on tumor type and location.

Materials and Methods: Between March 2002 and June 2005, 23 consecutive patients with gastric lesions were treated with laparoscopy procedures. Six patients presented with stromal tumors, 5 with benign lesions, and 12 with resectable gastric cancers.

Results: The patients were 13 men and 10 women, mean age 66.2 ± 11.1 years (range, 29–84 years). Five laparoscopic gastric wedge resections, 6 intragastric submucosal resections, and 12 gastrectomies (10 subtotal and 2 total) were performed. Mean operative time was 49.1 ± 18.8 minutes (range, 30–85 minutes) in the gastrointestinal stromal tumors and 64.1 ± 19.2 minutes (range, 45–90 minutes) in benign tumors. Gastrectomy required an average of 197.6 ± 36.9 minutes (range, 130–260 minutes). The mean times were 142.5 ± 9.6 minutes in the subtotal gastrectomy group with extracorporeal anastomosis and 190.8 ± 20.1 minutes when the anastomosis was totally laparoscopic (P < 0.002). All procedures were completed laparoscopically and there were no intraoperative complications. There were four postoperative complications: one wall hematoma secondary to the introduction of a trocar, one prolonged ileus, one intra-abdominal abscess, and one esophagojejunal leakage. Gastrointestinal stromal tumor patients were discharged after a mean 5.8 ± 1.3 days; patients with benign pathology after 5.2 ± 0.9 days, and gastric cancer patients after 10.7 ± 7.3 days (range, 6–28 days). The mean number of dissected lymph nodes in gastric cancer was 21.3 (range, 16–31).

Conclusion: Laparoscopic treatment of gastric lesions is technically feasible and safe. Compared to conventional surgery, it offers the advantages of low invasiveness and improved quality of life.
describe our recent experience with laparoscopic treatment of gastric tumors.

**MATERIALS AND METHODS**

Between March 2002 and June 2005, 23 consecutive patients with gastric lesions were treated at our institution. There were 13 males and 10 women, with a mean age of 66.2 ± 11.1 years (range, 29–84 years). Six patients presented with GIST, 5 with benign lesions, and 12 with resectable gastric cancers. A preoperative upper endoscopy with histologic study and abdominal computed tomography was performed in all patients in search of distant lymph nodes or metastasis. In 4 cases, endoscopic ultrasonography was performed.

In 5 patients (2 with GIST and 3 with benign tumors) tattooing was made by gastroscopy prior to surgery.

*Laparoscopic intragastric submucosal resection*

We begin with an initial laparoscopic exploration of the abdominal cavity and locate the gastric lesion. In lesions that are not visible on the serosal gastric surface, simultaneous intraoperative gastroscopy providing intragastric transillumination or the tattoo is used to locate the lesion. We place 2 or 3 working trocars. It is important to adapt the gastrotomy correctly to the location of the lesion. The resection is performed inside the gastric cavity, beginning 1–2 cm from the lesion, with ultrasound (Ligasure, Tyco Healthcare), preserving the mucosa. The specimen is placed into an endobag and extracted. Hemostasis and mucosal integrity are carefully checked. The operation concludes with a manual suture of the anterior gastric wall.

*Laparoscopic gastric wedge resection*

Exophytic lesions are identified by direct vision. Lesions in both curvatures of the omentum are partially freed, while in anterior gastric locations only a safety margin of the gastric wall is needed. The resection is performed with an EndoGIA stapler. If hemostasis is correct we do not add manual suture. The surgical specimen is extracted in an endobag.

*Laparoscopic gastrectomy*

The patient is placed in the supine position. The surgeon stands in the French position. After insertion of an umbilical Hasson trocar, the stomach and abdominal cavity are inspected (for size, location, mobility, lymph nodes, peritoneal or adjacent organ invasion). Two additional 10–12 mm trocars are inserted under direct vision along each midclavicular line, and a 5-mm trocar is inserted just below the xiphoid and left upper quadrant.

In cases of distal gastric cancer, we perform a potentially curative gastrectomy with D2 lymphadenectomy. When the tumor is located in the middle third of the stomach, total gastrectomy with D1 lymphadenectomy, adding groups 7, 8, and 9, is performed in the same way as in conventional open surgery.

The dissection begins at the transverse colon, dividing the gastrocolic ligament with a harmonic scalpel. The greater omentum is included. It is important not to dissect too deeply, so as not to injure the medial colic vessels. The dissection then continues to the level of the pylorus, including the peri- and infrapyloric lymph nodes. Duodenal section is performed with an endostapler and is followed by lymphadenectomy ascending into the hepatoduodenal ligament. Across the epiploic transcavity a section of the left gastric artery is performed at its origin, including the corresponding lymph nodes. The dissection of the major epiploic continues towards the spleen until the gastric resection is reached, usually at the level of the second or third short vessels in subtotal gastrectomy, or of all the short gastric vessels in total gastrectomy, including the cardiac nodes in these cases (group 2).

Subtotal gastrectomy is performed with an endostapler (EndoGIA, Tyco Healthcare), using several 40-mm charges. Hemostasis must be carefully checked and, in some cases, hemostatic sutures added. The surgical specimen is extracted through a 7–10 cm subxyphoid incision.

An antecolic side-to-side Roux-en-Y anastomosis (Billroth III) is performed with endostaplers, as in the Billroth II procedure. When assisted extracorporeal suture is performed, a 10-cm subxyphoid incision facilitates exteriorization of part of the laparoscopically mobilized stomach and it is transected using conventional stapling devices.

In total gastrectomy, the dissection is completed with the mobilization of the abdominal esophagus and a circular mechanical esophagojejunal anastomosis is performed with an EEA 25, introducing the anvil into a nasogastric tube. Then the jejunal stump is closed by endo-GIA and a side-to-side jejuno-jejunal anastomosis at the foot of the Roux-en-Y is performed by endostapler and the jejunum is closed by hand suture. A drain is usually placed at the duodenal stump.

**RESULTS**

During the study period, 23 patients with gastric tumors were operated on using a laparoscopic approach. In 6 patients who presented with stromal tumors, 5 laparoscopic gastric wedge resections and 1 intragastric submucosal resection were performed. All 5 patients with benign tumors underwent laparoscopic intragastric submucosal resections (Table 1).
Ten subtotal gastrectomies and 2 total gastrectomies were performed in 12 patients with resectable gastric cancer. A B-II reconstruction was performed in 7 cases and B-III in the 3 remaining cases. Six of these reconstructions were performed totally laparoscopically, while the other 4 were extracorporeal. As for the 2 total gastrectomies, one reconstruction was entirely laparoscopic, while the other was assisted and the esophagojejunal anastomosis was extracorporeal (Table 2).

Mean operative time was 49.1 ± 18.8 minutes (range, 30–85 minutes) in the GIST group and 64.1 ± 19.2 minutes (range, 45–90 minutes) in patients with benign tumors. Gastrectomy required an average of 197.6 ± 36.9 minutes (range, 130–260 minutes); the mean time in the subtotal gastrectomy group with extracorporeal anastomosis was 142.5 ± 9.6 minutes compared with 190.8 ± 20.1 minutes when the anastomosis was totally laparoscopic ($t = 4.416; P < 0.002$). All the procedures were completed laparoscopically and there were no intraoperative complications.

There were four postoperative complications. One patient with GIST had an abdominal wall hematoma secondary to the introduction of a trocar. Three other complications appeared in the gastric cancer group: one prolonged ileus for 7 days, one intra-abdominal abscess that required a laparotomy, and one esophagojejunal leakage that was treated conservatively. No anastomotic bleeding or stenosis was seen.
Oral intake was restarted 48 hours after the surgery in all patients undergoing submucosal resections. Fourteen of the 17 patients who underwent gastric resection resumed oral intake after 72 hours; two patients on postoperative day 4; and the patient with the prolonged ileus on postoperative day 8.

Mean postoperative stay in the GIST group was 5.8 ± 1.3 days; 5.2 ± 0.9 days in the benign tumor group; and 10.7 ± 7.3 days (range, 6–28 days) for the gastric cancer patients.

Histologic examination showed one inflammatory fibroid polyp, two leiomyomas, one hamartoma, one adenomyoma, and six stromal tumors. Eight of the gastric cancers were intestinal, three diffuse, and one mixed (Table 3). The mean size of gastric cancers was 3.8 ± 0.7 cm and the clear margin resected was at least 5 cm in all cases. The mean number of dissected lymph nodes was 21.3 ± 5 (range, 16–31).

The mitotic activity of GIST tumors was <5 mitoses/50 high-power field (HPF) in five cases. Only an 84-year-old patient had >5 mitoses/50 HPF: her tumor was >5 cm and she refused imatinib treatment.

The median follow-up in patients with benign lesions was 31 months (range, 38–3) and there was no evidence of tumor recurrence. In the patients with gastric cancer, no recurrence was detected at a median follow-up of 25.8 months (range, 4–73 months).

The data were entered in a Windows 2000 Access database. Data are expressed as mean ± standard deviation. Significance was taken at the level of $P < 0.05$.

### DISCUSSION

Many interventions traditionally performed using an open approach are now successfully treated by laparoscopy and this approach has had a great impact on current surgical practice, modifying many established surgical concepts. However, the laparoscopic treatment of gastric tumors was not initially accepted due to the technical complexity it presented, the lack of evidence of the advantages of laparoscopic over open surgery and, above all, the belief that a radical oncologic resection could not be achieved.

In recent years, experienced laparoscopic groups have benefited from the development of advanced laparoscopic procedures (harmonic scalpel, improved optical instruments) and are now able to perform these procedures successfully using laparoscopy.

In general, the main advantages of the laparoscopic approach in these procedures are low invasiveness and improved quality of life. Less intraoperative bleeding, less postoperative pain and a more rapid recovery, early return of bowel function and oral food intake, and shorter hospital stay have also been described with these laparoscopic procedures.

Gastric mucosal or submucosal tumors are infrequent, though upper endoscopy and radiologic explorations have considerably increased the number of cases diagnosed. The symptoms are varied, depending on the size, location, and tumor growth (endoluminal or extraluminal). Endoscopic diagnosis is often difficult, especially in stromal tumors which may have extraluminal growth; in certain locations, diagnosis is difficult to establish even with endoscopic ultrasound, and resection by fibrogastric in lesions larger than 3 cm is not always possible. Re-section of these lesions by the laparoscopic approach, with or without simultaneous intraoperative endoscopy to facilitate their location for direct vision or tattooing of the adjacent gastric wall, allows diagnosis and a minimally invasive treatment. In the past, a laparotomy would have been required and, in many cases, the gastric resection was unnecessarily wide.

The outcomes in cases of stromal gastric tumors are strongly dependent on tumor size and mitotic activity. The main operative principle is to resect the tumor with 2–3 cm of clear margins, avoiding tumor rupture (Fig. 1).

Success has been reported with laparoscopic intragastric or wedge resections and, in our view, this is the ideal
treatment for this pathology today. Depending on the location and the tumor size, we can perform a resection tailored to each patient’s circumstances. Submucosal transgastric resection seems to be the ideal approach in benign lesions of the posterior face, while in anterior lesions or in stromal tumors, we need to resect the lesion with safety margins, we prefer a wedge resection of the stomach.

Several technical aspects should be borne in mind. First, it is extremely important to select the correct trocar location, especially in intragastric resections. Second, we need to preserve the vagus nerve in lesions of the lesser curvature in order to avoid postoperative atonic distension of the stomach. Third, bleeding in the resected mucosa must be controlled and, in prepyloric lesions or lesions of the esophagogastric junction, wide resections that could cause stenosis must be avoided. In these cases, Choi recommends laparoscopically assisted gastrectomy but, to date, we have not needed to use this procedure.

Treatment of gastric cancer requires radical gastric resection. For tumors located in the upper or middle third, a total gastrectomy is advisable, while in distal tumors subtotal gastrectomy with a clear 5–6 cm margin for intestinal tumors or 10 cm in diffuse tumors is the accepted treatment in our institution. There is no consensus on the extent of lymph node dissection. Asian groups perform D2 or D3 dissection, but most groups in the West prefer a more limited D1 dissection that is associated with less postoperative morbidity and mortality. In open surgery, our group performs a subtotal gastrectomy with D2 lymphadenectomy in distal gastric cancer and total gastrectomy with D1 extended to groups 7, 8, 9 of level D2 when the tumor is located in the middle third of the stomach.

Laparoscopic gastrectomy can only be accepted as an effective alternative to open surgery if it achieves the same degree of oncologic effectiveness with a similar or improved rate of postoperative complications. Initially Asian groups reported successful results in the laparoscopic treatment of early gastric cancer. Since then, good results have been reported with subtotal and total laparoscopic gastrectomies in resectable gastric cancer, performed entirely by laparoscopy or assisted, with acceptable oncologic lymph node dissections. These results were comparable to those achieved in open surgery and, evidently, the morbidity and mortality rates were similar.

Studies comparing laparoscopic vs. open subtotal gastrectomy report less surgical trauma and postoperative pain, shorter hospital stay, faster resumption of gastrointestinal functions, and a lesser depression of respiratory capacity. In a recent randomized study comparing laparoscopic to open subtotal gastrectomy with D2 lymph node dissection, Huscher confirmed that laparoscopic gastrectomy is a feasible and safe alternative, finding no differences between the groups overall and in disease-free survival at 5 years. As with other laparoscopic procedures, Huscher also reported advantages such as lower intraoperative blood loss, earlier resumption of oral intake, and earlier discharge from hospital.

We have performed laparoscopic gastrectomy in only a small group of gastric cancer patients and we are still gaining experience. Nonetheless, our initial results with this technique for treatment of gastric cancer are very promising.

Performing the anastomosis totally by laparoscopy significantly increases surgical time. We are confident that, as we become more skilled, we will be able to reduce the time required. In the cases we have performed, the number of lymph nodes extracted and the postoperative complication rates are similar to those obtained with open surgery.

Although the technique is still in a developmental phase and few series have been published to date, the signs are that, in experienced hands and with appropriate patient selection, laparoscopic gastrectomy in gastric cancer is a safe procedure and a valid alternative to open surgery. Of course, laparoscopy must be able to reproduce exactly the same oncologic results as those obtained using open techniques.

The laparoscopic treatment of gastric lesions is technically feasible, safe, minimizes the access trauma of laparotomy, and offers advantages over conventional surgery in terms of low invasiveness and improved quality of life. In the treatment of benign tumors larger than 3 cm, and in stromal tumors, it seems to be the best current option, allowing resection that is tailored to each patient’s individual circumstances. In gastric cancer, the initial results are promising and we must wait for the long-term results of randomized studies that can define the real usefulness and oncologic effectiveness of this technique.

REFERENCES


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